PERPETUAL MOTION MAGNETIC ELEVATION TOY

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ABSTRACT

Perpetual motion magnetic elevation (PMME) toy is a smart toy which combines two mechanical systems to works. Perpetual motion and magnetic elevation system was introduced since hundred years ago. This toy usually used as office desk decoration and it function is limited. Although this toy has been introduced, but not everyone knows how it is made and works. This report will explain the investigation of the mechanical system behind this toy and the process in making this toy. At the end of this project, we will know how this toy has been made and what materials involved. We will also know how the mechanical systems can create the movement on this toy. Ultimately, perpetual motion magnetic elevation toy is not just a toy to be played by children and as a desk decorative but it can be source of ideas to create a new technology which can save our planet that has long been desired by the peoples.

ABTRAK

Alat permainan pergerakan terus angkatan magnet adalah sejenis alat permainan pintar yang menggabungkan dua system mekanikal untuk berfungsi. Sistem pergerakan terus dan angkatan magnet telah diperkenalkan sejak beratus tahun yang lalu. Alat permainan ini biasanya digunakan sebagai alat perhiasan meja di pejabat dan fungsinya terhad. Walaupun alat permainan ini telah lama diperkenalkan, tidak semua orang tahu bagaimana ia dibuat dan berfungsi. Laporan ini akan menerangkan penyiasatan sistem mekanikal disebalik alat permainan ini dan proses pembuatan alat permainan ini. Pada akhir projek ini, kita akan mengetahui bagaimana alat permainan ini dibuat dan bahan-bahan yang terlibat. Kita juga akan mengetahui bagaimana system mekanikal boleh menggerakan alat permainan ini. Akhir kata, alat permainan gerakan terus angkatan magnet bukan sahaja alat permainan untuk dimain oleh kanak-kanak dan perhiaasan meja, bahkan ia boleh menjadi sumber idea untuk menghasilkan sebuah teknologi baru yang boleh menyelamatkan planet kita yang telah lama diidamkan oleh orang ramai.

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CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

For this chapter, we will discuss about the project background, problem statement, objective of the project, and scope of the project.

1.2 PROJECT BACKGROUND

Perpetual motion magnetic elevation toy is a combination of two systems which produce a mechanical system to make it work. Magnets has two functions which is to float the object and as a source of energy to move the object continuously. The example for this toy which already sold in market is levitator strobe (figure 1.1). This toy looks simple but the system behind this toy makes it known as a smart toy. This toy has been sold in the market but it seems to be the same design from the past till the present and the price is quite high. However, this toy remains an attraction to children or adults.

This project is supervised by Mr. Nasrul Hadi bin Johari who give advices during carry out this project. This project is to fabricate a perpetual motion magnetic elevation toy and make improvement with the existing toy in the market. It is also to investigate how mechanical system works behind this toy.

Figure 1.1: Levitator strobe

1.3 PROBLEM STATEMENT

Although these toys have long been introduced and are readily available in the market, but the design has not changed much from the beginning it was introduced until now. These toys are usually used as decoration for table and the price is quite expensive. While, many people still do not know how the system works behind this toy, which enable it create an interesting movement. So, what modification should be done to meet the customer need and how the mechanical system behind this toy works? Is this system has potential to be developed for the benefit of mankind?

1.4 OBJECTIVE

The objective of this project is:

1) To fabricate perpetual motion magnetic elevation toy with new characteristics.
2) To study the mechanical system behind the toy and how it can be developed to benefit of mankind.

1.5 PROJECT SCOPES

To ensure to project is under control and stick with the title, the scopes of project is discussed. Every scopes of this project are the task of the student and it is under student responsibilities.

This project covers:

i. Fabricate perpetual motion magnetic elevation toy.
ii. Investigate the mechanical system works behind the toy.

1.6 PROJECT FLOW CHART

Project flow chart (figure 1.2), is a graphical representation of a process or system that details the sequencing of steps required to create output.

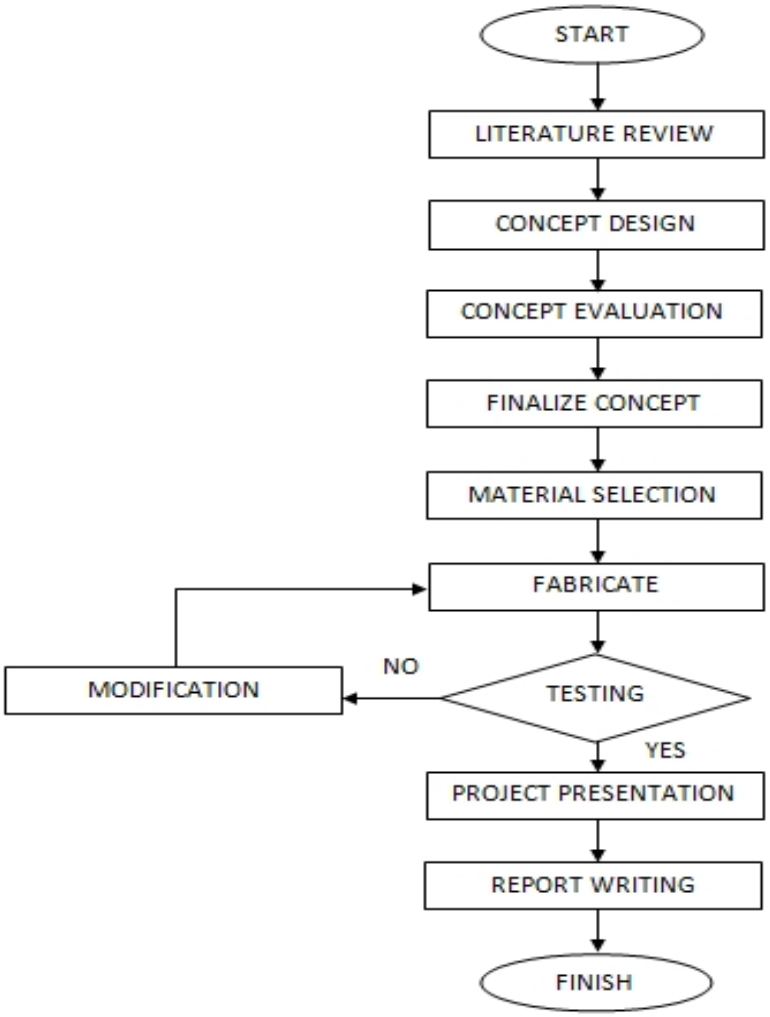


Figure 1.2: Project flow chart

CHAPTER 2

LITERATURE STUDY

2.1 INTRODUCTION

This chapter consists of further information about perpetual motion magnetic elevation toy. There are two main systems which are perpetual motion and magnetic elevation combined in this toy to make it work. As we know, perpetual motion is ability to moves continuously and the magnetic elevation is ability to float by help of magnetic force. This chapter will explain these systems work in this toy.

2.2 PERPETUAL MOTION MAGNETIC ELEVATION (PMME) TOY

2.2.1 Common Perpetual Motion Magnetic Toy

The perpetual motion magnetic elevation toy (figure 2.1) is a combination of the two systems which are perpetual motion and magnetic levitation (maglev). The magnetic field produced will repels the both parts each other then it will make the upper part to float or suspend. When a force is applied on the float part, it will generate the momentum to keep moving. The reaction of poles on the magnet allows the part rotates on fix position.

Figure 2.1: Common perpetual motion magnetic elevation toy

2.2.2 Other Perpetual Motion Magnetic Elevation Toy

The other example of perpetual motion magnetic elevation toy which does not use battery or electric energy to move is Magic UFO (figure 2.2). This toy uses a large round magnet as it base and a small magnet as the UFO. The UFO must be rotated faster to make it float on air with stable.

Figure 2.2: Magic UFO

2.3 PERPETUAL MOTION

2.3.1 Perpetual Motion History

Perpetual motion is referring to something that move continuously when a force is applied on it. The perpetual system has been discovered since hundred years ago and it is used to invent perpetual motion machines. The first documented

perpetual motion machines were described by the Indian author Bhaskara (c.1159) which called Bhaskara's wheel (figure 2.3). This wheel contains with mercury around its rim. As the wheel turns, the mercury is supposed to move within the containers in such a way that the wheel would always be heavier on one side of the axle. Perhaps this is not so much a practical proposal as an illustration of Indian cyclical philosophy. The idea reappears in Arabic writings, one of which contained six perpetual motion devices. From the Islamic world the idea reached Europe.

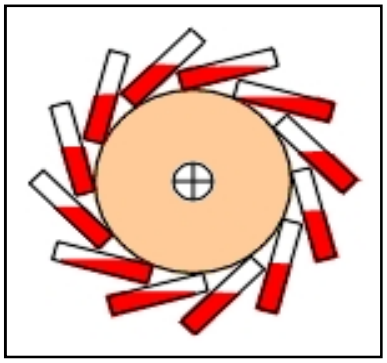


Figure 2.3: Bhaskara's wheel

Another inventor that was developed this system is Leonardo da Vinci (1452-1519). The machine invented by Leonardo had purpose to pump the water. Many of Leonardo's drawings of machines were impractical or even unworkable as he depicted them. Most were never built or tested by him. Some were not his original ideas, but were commonly known in his time and earlier times. We often cannot determine whether a particular device included in his notebook was his own design, or of someone else, and we cannot always know whether Leonardo considered it workable or practical. Figure 2.4 shows the Leonardo's drawing of perpetual motion wheels.

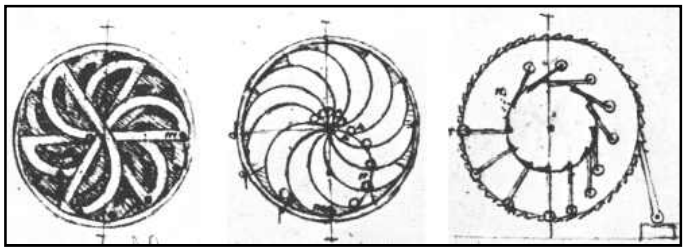


Figure 2.4: Leonardo's drawing of perpetual motion wheels.

2.3.2 Perpetual Motion and Physics

Perpetual motion machine produces more work or energy than it consume, whether they might operate indefinitely or not. The machine can operate by itself which produce useful work without energy input. That means the machine is 100% efficient and no energy lost on the system. This statement has been a mystery among scientists whether they have violated the laws of thermodynamics or not.

The first law of thermodynamics is the law of conservation of energy applied to heat engines. It states that the work output from an engine cannot exceed the energy input. The perpetual motion machine described above violates the first law of thermodynamics. The generator portion generates efficient electricity to run other devices as well as power the generator. Hence once this perpetual motion machine is set in motion, it produces useful work without any energy input. Free work out with no energy in violates the first law of thermodynamics. Energy is being created from nothing.

First law thermodynamics equation:

$$\Delta U = Q - W$$

Change in internal energy — Heat added to the system — Work done by the system

The second law of thermodynamics says that an engine or process of any type must always have an efficiency of less than 100%. A perpetual motion machine that uses a generator to power the motor that runs the generator requires both the generator and motor to operate with 100% efficiency. This type of perpetual motion machine does not violate the first law of thermodynamics, but violates the second law of thermodynamics. It is a perpetual motion machine of the second kind because it violates the second law of thermodynamics. Figure 2.5 shows the energy conversion of heat engine in thermodynamics theory.

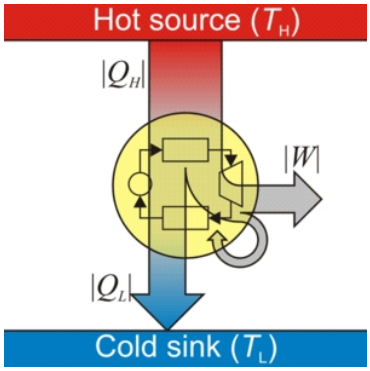


Figure 2.5: Heat engine diagram

In term of that, no engineer or inventor cannot build a perpetual motion machine because it would violate either the first or second law of thermodynamics, which are fundamental laws of physics.

However, this does not mean that we cannot strive to come close to perpetual motion and it definitely does not mean that some of these machines would not have the potential to produce energy without the use of fossil fuels. Some perpetual motion device use get the energy from gravity and magnet. The example of perpetual motion device that use gravity as source of energy is Bhaskara's wheel (figure 2.6). The motion is done by making the moment due to gravity on one side of a wheel greater than the moment due to gravity on the other side. The wheel would have equal masses surrounding it and gravity remains constant.

Figure 2.6: Bhaskara's wheel

To make the wheel spin the sum of the moments must not equal zero, the only way to ensure this happens is to change the radius. This is the example of force and moment calculation on Bhaskara wheel that use gravity force as source of energy to move the wheel. Figure 2.7 shows the calculation of each ball on Bhaskara's wheel:

Force = (Mass)(Acceleration)

Moment = (Force)(Radius)

Mass of each ball = 1kg

l_i= 0.5m

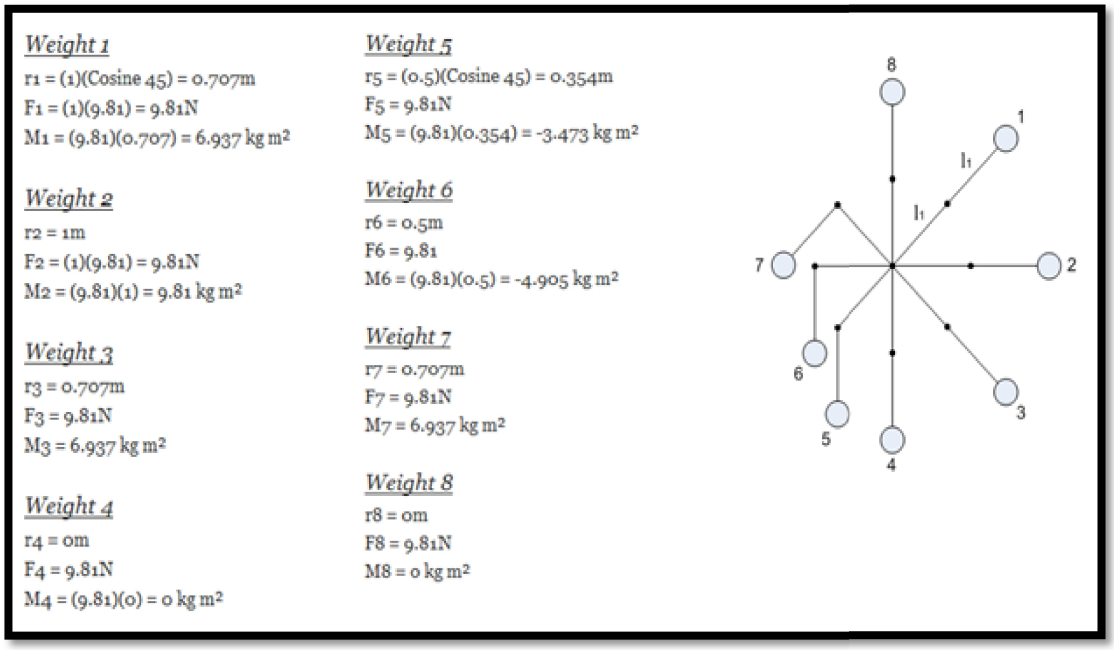


Figure 2.7: Example of calculation on Bhaskara's wheel

Sum of the moments

ΣM = 6.937 + 9.81 + 6.937 + (-3.473) + (-4.905) + (-6.937) = +8.369

There is a clockwise moment of **8.369 kg m².**

2.3.3 Perpetual Motion Toy

The example for perpetual motion toy is Nowton's cradle (figure 2.8). This perpetual motion toy does not use magnet to move. The pendulums are tied on the frame with a same length. The same momentum force allows the pendulums to move continuously.

Figure 2.8: Newton's Cradle

2.4 MAGNETIC ELEVATION

2.4.1 Magnetic Elevation History

Magnetic elevation or synonym with magnetic levitation (maglev) is a form of system that suspends, guides and propels the suspended object using magnetic forces. This system was developed since 1905 by Alfred Zehden from German which was invented linear induction motor (LIM) for driving trains or lift. Alfred Zehden was awarded U.S. Patent 782,312 (21 June 1907) and U.S. Patent RE12, 700 (21 August 1907). Figure 2.9 shows the LIM pattern.

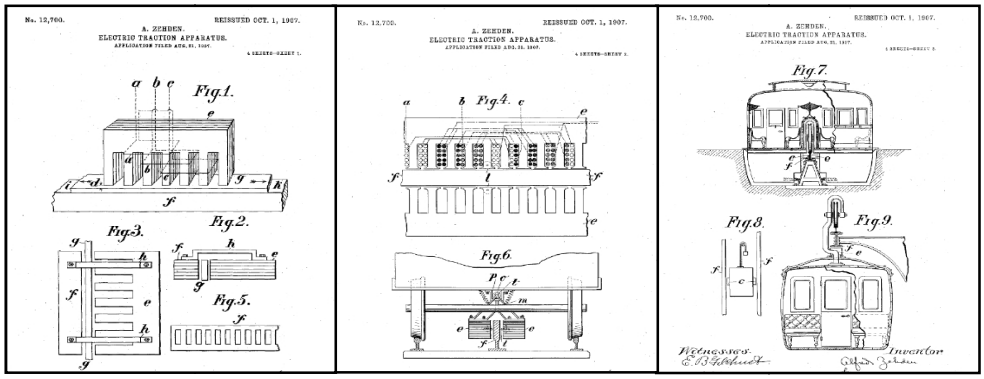


Figure 2.9: First LIM patent by Alfred Zehden

2.4.2 Application of Magnetic Elevation

Maglev technology commonly used in constructing a high-speed train. The magnetic field between the train and track make the train suspended and linear induction motor (LIM) is mounted to the track to propel the train forward. This system is called Electro Magnetic Suspension (EMS). EMS would be able to continually switch poles and keep the train moving while the trains will always be suspended on the track. Figure 2.10 details the explanation.

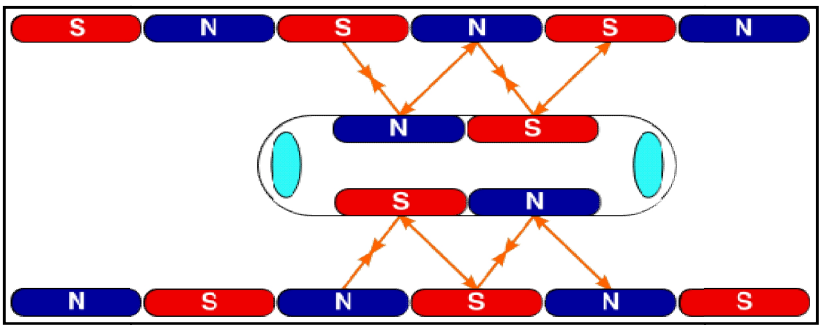


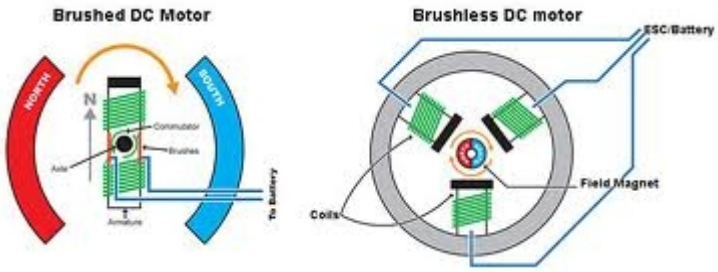
Figure 2.10: Electro Magnetic Suspended (EMS) system works

This system was used on Maglev Train (figure 2.11) at German and Bullet Train (figure 2.12) at Japan. This system supports the object without physical contact which can prevent frictions force between the moving object.

Figure 2.11: German's Maglev Train

Figure 2.12: Japan's Bullet Train

Another example using magnetic elevation is electric brushless motor (figure 2.13a). This motor is more efficient compared to electric brushed motor (figure 2.13b) because it has less frictional force hence reducing the heat when operate.



(a) (b)

Figure 2.13: Application of magnetic elevation. a) Brushed motor; b) Brushless motor.

2.4.3 Magnetic Elevation Toy

There are many types of magnetic toy sold in the market. The magnet is use either to move the toy or to float the toy. The example of magnetic toy is antigravity globe (figure 2.14). The magnet on this toy is used to levitate the globe and let it to float. There is no contact between the globe with the base hence let the globe to spin freely.

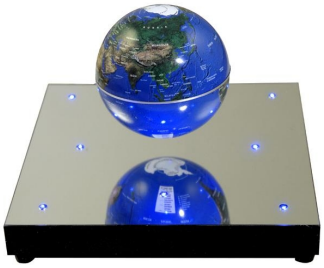


Figure 2.14: Antigravity globe

CHAPTER 3

METHODOLOGY

3.1 INTRODUCTION

In this chapter, the work progress that involved in this project will be showed. The steps involved in this chapter are classification, concept design and evaluation, material selection, fabrication and bill of materials.

3.2 PRELIMINARY CONCEPT

The concept of toys to be made must meet the criteria. The main criteria's are perpetual motion and magnetic elevation. The example of toy which exists in current market and meets the criteria is levitator strobe (figure 3. 1). The toy will be selected as datum concept during designing the new concept.

Figure 3.1: Levitator strobe

3.3 CONCEPT SKETCHING

3.3.1 Concept A

Concept A (figure 3.2) has a small stationery pocket. This concept is thicker than datum concept. The floating part is same like datum concept.

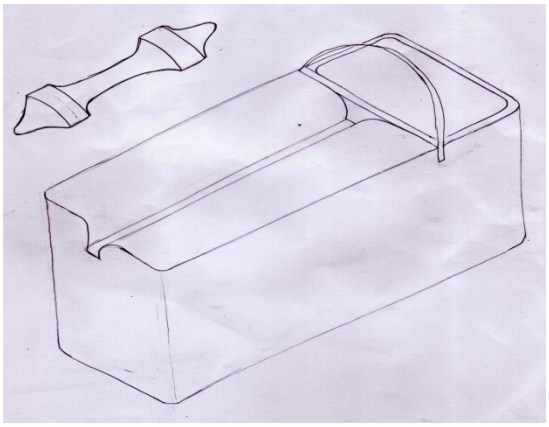


Figure 3.2: Concept A

3.3.2 Concept B

Concept B (figure 3.3) is modification from concept A. The pocket is replaced to at the long side of the base part. The floating part is designed as a rocket.

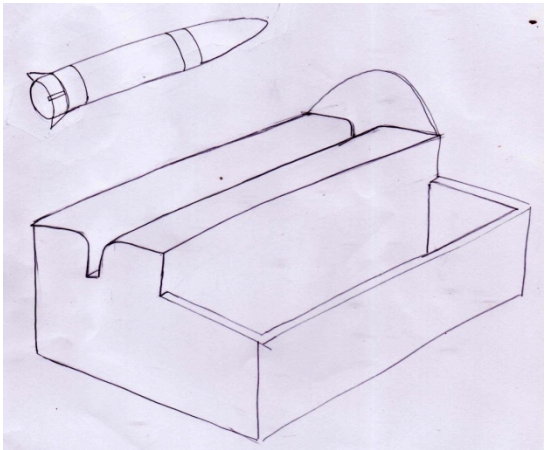


Figure 3.3: Concept B

3.3.3 Concept C

Concept C (figure 3.4) is designed like ‘X’ letter. This concept is thinner than concept A and concept B. The floating part is same like datum concept.

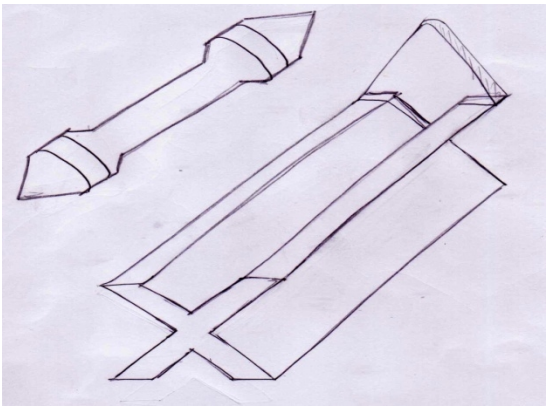


Figure 3.4: Concept

3.4 CONCEPT EVALUATION

3.4.1 Concept Screening Matrix

Concept screening matrix (table 3.1) shows the comparison between each concept. The concepts are evaluated with datum concept which already sold in the market.

Table 3.1: Screening concept matrix

Selection criteria		Concept variants		
		Concept A	Concept B	Concept C
Safe for kid		0	0	-
Stability		0	0	-
Aesthetically pleasing		0	-	-
Cost		+	-	+
Durability		0	0	-
Stationery pocket		+	+	0
	Plus	2	1	1
	Same	4	3	1
	Minus	0	2	4
	Net	2	-1	-3
	Rank	1	2	3
	Continued	Yes	Yes	No

From the concept screening matrix, concept A and B has been chosen to continue to next step. The next step is concept benchmarking matrix.

3.4.2 Finalize Concept Sketching

Datum concept is combined with concept A to get a finalize concept (figure 3.5). This concept has thinner base part and has a stationery pocket at the side of this part. The concept is evaluated in concept benchmarking matrix.

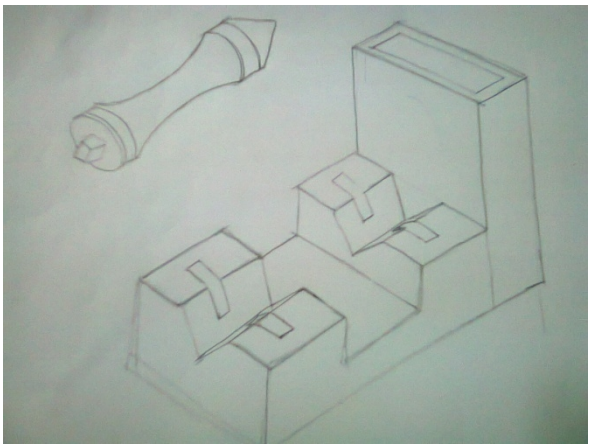


Figure 3.5: Finalize concept

3.4.3 Concept Benchmarking Matrix

Concept benchmarking matrix (table3.2) will review the scoring of the concept. Concept A will combined with datum concept to get a better design.

Table 3.2: Concept benchmarking matrix

Selection criteria	Weight	concept A + regular concept		concept B	
		Rating	Score	Rating	Score
Safe for kid	20%	4	0.8	2	0.4
Stability	15%	4	0.6	3	0.45
Aesthetically pleasing	15%	4	0.6	3	0.45
Slotted for round magnets	20%	5	1.0	5	1.0
Durability	15%	4	0.6	2	0.3
Stationery pocket	15%	4	0.6	3	0.45
	Total score	4.2		3.05	
	Rank	1		2	

From the concept benchmarking matrix, combination of concept A and datum concept has the highest score. This concept will be continued to fabrication process.

3.5 Computer Aided Drawing

3.5.1 Dimension

The dimensions of the parts are in millimeter unit. Part 1 (figure 3.6) and part 2 (figure 3.7) will combined together and part 3 (figure 3.8) is combination of wood and round magnets.

Part 1: Base part

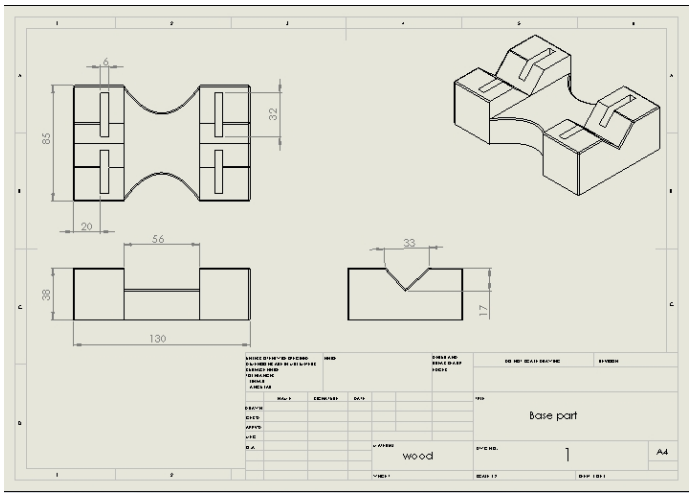


Figure 3.6: Base part dimension

Part 2 : Stationery pocket

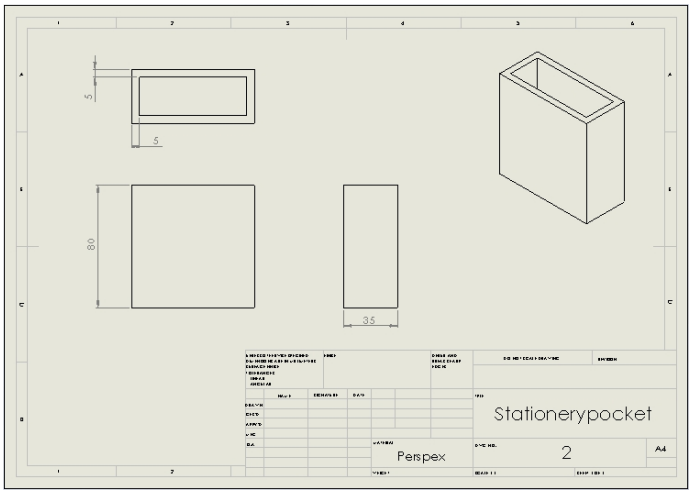


Figure 3.7: Stationery pocket dimension

Part 3: Strobe

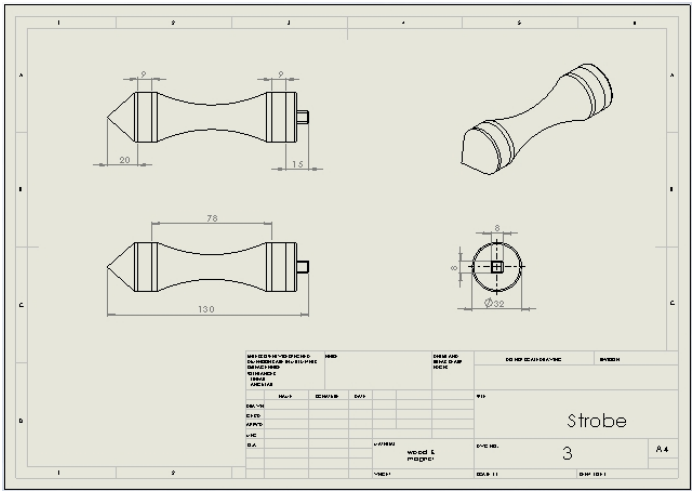


Figure 3.8: Strobe dimension

3.5.2 Isometric View

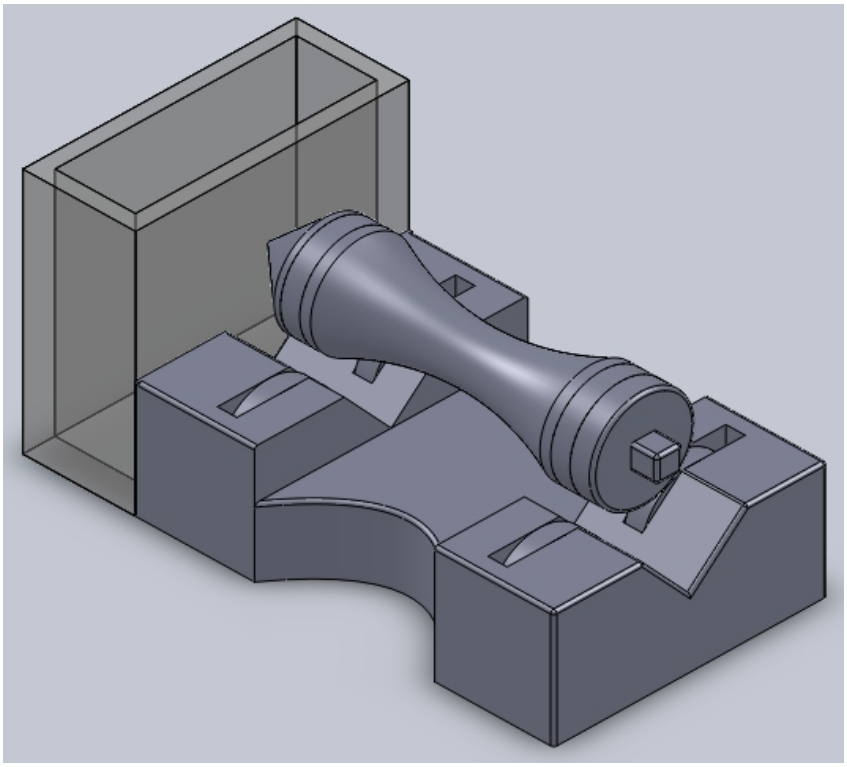


Figure 3.9: Isometric view

3.5.3 Exploded View

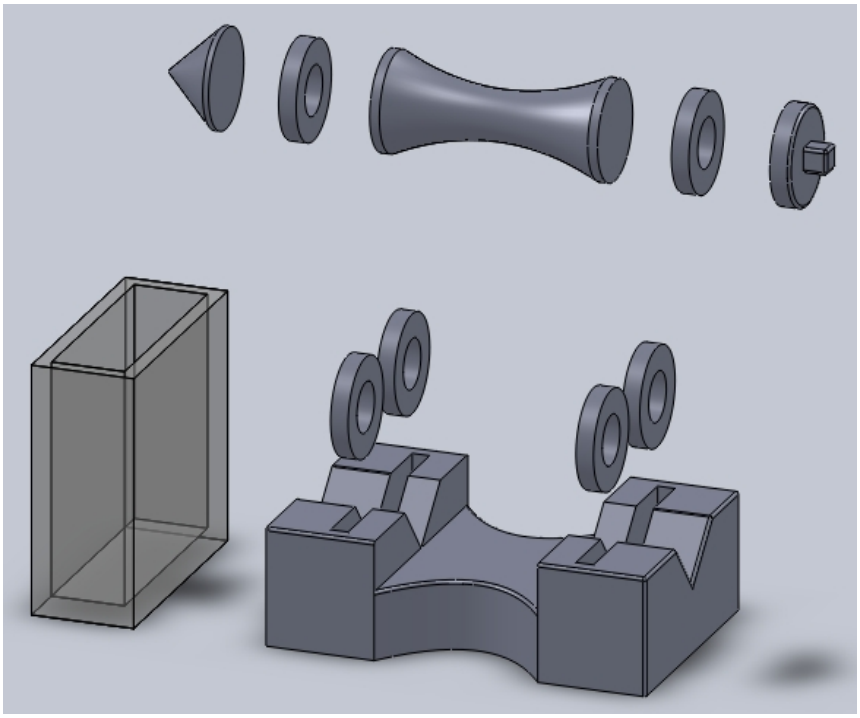


Figure 3.10: Exploded view